

AMERICAN SOCIETY OF HEATING, REFRIGERATION AND AIR-CONDITIONING
ENGINEERS, INC.

1791 Tullie Circle, NE / Atlanta, GA 30329
404-636-8400

TC/TG/TRG MINUTES COVER SHEET

(Minutes of all meetings are to be distributed to all persons listed below within 60 days following the meeting.)

TC/TG/TRG No. TC 4.7 DATE: June 30, 2015

TC/TG/TRG TITLE: Energy Calculations

DATE OF MEETING: June 30, 2015 LOCATION: Atlanta

MEMBERS PRESENT	YEAR	MEMBERS ABSENT	YEAR	EX-OFFICIO MEMBERS &
Joe Huang (CHAIR)	2012			
Bass Abushakra (VICE CHAIR)	2012	Dr. Michael Wetter	2011	See attendance sheet additional attendees
Dr Jeff Haberl. PhD (Research)	2015	Dr Daniel E Fisher	2011	
Joel Neymark (Standards Chair)	2011	Chris Balbach (SEC)	2013	
Dr Wangda Zuo	2013	Keith Cockerham(Prg)	2013	
Dr Kamel Haddad, PhD	2013	Dr. Malcolm Cook	2012	
Erik Kolderup (Handbook)	2013			
Joshua New (Webmaster)	2015			
Dru Crawley (SCM)	2015			
Ralph Muehleisen (DDM)	2013			
Ron Judkoff (Applications)	2013			
Tim McDowell	2015			
Chip Barnaby	2015			

Total attendance of voting members: 7 present, 5 absent.

DISTRIBUTION

ALL MEMBERS OF THE TC/TG/TRG

TAC CHAIR

Walter T. Grondzik

TAC SECTION HEAD

Michael R. Bilderbeck

SPECIAL PUBLICATIONS LIAISON

STANDARDS LIAISON

James Dale Aswegan

HANDBOOK LIAISON

David P Yuill

RAC RESEARCH LIAISON

PROF DEV COMM LIAISON

Hugh D. McMillan

CHAP TECH TRANSFER LIAISON

Harris Sheinman

STAFF LIAISON (RESEARCH)

Michael Vaughn

STAFF LIAISON (TECH SERVICES)

Michael Vaughn

STAFF LIAISON (STANDARDS)

HANDBOOK RESPONSIBILITIES

Year & Volume	Chapter Title	No.	Deadline	Handbook Subcom. Chair/Liaison
2017 Fundamentals	Energy Estimating Methods	19	June 2016	Kolderup/Yuill

These draft minutes have not been approved and are not the official, approved record until approved by this committee.

**ASHRAE TC 4.7 Energy Calculations
Atlanta Meeting**

MOTIONS AND ACTION ITEMS

MOTION: A motion passed to review the minutes from the Atlanta meeting; 6-0-0 CNV.

MOTION: Orlando Program: 4 Seminars and 1 Workshop are proposed, including a Seminar on Calibration (DDM) and a Seminar on Technology Performance (SCM). A motion to approve the Program by Judkoff, Kolderup seconded motion to approve the program (6-0-0-CNV).

TC/TG/TRG MEETING SCHEDULE				
LOCATION – past 12 months		DATE	LOCATION - planned next 12 months	DATE
Chicago		January 27 2015	Orlando	January 22, 2016
Atlanta		June 30, 2015	St. Louis	June 2016
TC/TG/TRG SUBCOMMITTEES				
Function			Chair	
Program			Keith Cockerham	
Research			Jeff Haberl	
Handbook			Erik Kolderup	
Standards			Joel Neymark	
Data Driven Models			Ralph Muelensien	
Simulation and Component Models			Drury Crawley	
Applications			Joe Huang	
RESEARCH PROJECTS – Current			Monitoring	Report Mode
Project Title	Contractor		Comm.Chm.	At Meeting
LONG RANGE RESEARCH PLAN				
Rank	Title	W/S Written	Approved	To R & T
HANDBOOK RESPONSIBILITIES				
Year & Volume	Chapter Title	No.	Deadline	Handbook Subcom. Chair/Liaison
2017 Fundamentals	Energy Estimating Methods	19	June 2016	Kolderup/Yuill
STANDARDS ACTIVITIES - List and Describe Subjects				
SPC 140 Standard Method of Test for Building Energy Software – Ronald Judkoff				
SPC 205 Data Exchange Protocols for Energy Simulation of HVAC&R Equipment Performance - Chip Barnaby				
SPC 209 Energy Simulation Aided Design – Jason Glazer				
TECHNICAL PAPERS from Sponsored Research - Title, when presented (past 3 yrs. present & planned)				
Appendix 3				
TC/TG/TRG Sponsored Seminars - Title, when presented (past 3 yrs. present & planned)				
Appendix 4				
TC/TG/TRG Sponsored Forums - Title, when presented (past 3 yrs. present & planned)				
Appendix 5 - NONE				
JOURNAL PUBLICATIONS - Title, when published (past 3 yrs. present & planned)				
None				

Attendance

Below is a complete listing of attendees at this meetings. It includes the voting members of the committee listed on the first page

Present at Meeting														Status 01/16
Atlanta June 2015		Chicago Jan 15		Seattle Jun' 14		New York Jan 14		Denver Jun'13		Dallas Jan'13	Last Name	First Name	Affiliation	VM Voting CM Corres., V Visitor
YEA	Non-YEA	YEA	Non-YEA	YEA	Non-YEA	YEA	Non-YEA	YEA	Non-YEA					
	X			X		X	X			X	Abushakra	Bass	Milwaukee School of Eng	VM
	X	X		X		X	X				Adams	Mark	ORNL	V
			X		X		X				Anderson	JR	Anderson Engineering	V
				X			X		X		Armstrong	Peter	Masdar Institute	V
			X								Ashukov	Artem	Remak a s	Guest
					X						Bae	Nuri	Univ. of Michigan	V
											Balaras	Costas	NOA	V
			X				X		X	X	Balbach	Chris	Performance Systems De	VM
	X		X		X				X	X	Baltazar	Juan-Carlos	Texas A&M University	V
						X			X	X	Baker	Chris	The Weidt Group	V
	X		X		X				X	X	Barnaby	Chip	Wrightsoft	VM
											Beausoleil-Morrison	Ian	Carleton University	CM
						X				X	Berardi	Umberto		V
	X										Bhandari	Mahabir	ORNL	V
										X	Bilderbeck	Mike	Pickering Firm	V
									X		Bing	Dong	UTSA	V
							X			X	Bosworth	David	BuildLab	V
	X		X						X		Brooks	Alamelu	-	V
										X	Carling	Par	EQUA	V
	X		X		X		X				Carpenter	Patrick	Fac Per Feng	CM
											Clark	Jordan	UT-Austin	V
			X				X		X	X	Cockerham	Keith	DLB Associates	VM
										X	Collyer	Breesa	PG&E	V
			X		X				X	X	Cook	Malcolm	Loughborough Univ (UK	VM
	X		X		X		X		X	X	Cornick	Steve	Nat'l Research Council C	V
	X		X		X		X		X	X	Crawley	Dru	Bentley	CM
	X				X					X	Cumali	Zulfi	Energy System	
											Davidson	Tom	DLB Associates	V
					X		X		X	X	Degelman	Larry	TAMU	CM
			X		X		X		X	X	DeGraw	Jason	Penn State Univ	V
							X				Deringer	Joseph	Superb	V
			X								Dong	Bing	UTSA	Guest
											Eley	Charles	COMNET	V
	X		X		X		X			X	Ellis	Peter	Big Ladder Software	CM
	X		X		X		X		X		Fallahi	Ali	Fraunhofer CSE	
									X		Feng	Wei	LBN L	V
									X		Firrantello	Joseph	PSU	V
					X				X	X	Fisher	Dan	Oklahoma State Univ	VM
	X								X		Fontanini	Anthony	Iowa State Univ	V
											Frame	Sara	Eaton's Energy Solutions	V
											Franconi	Ellen	Rocky Mountain Institut	V
											Friedman	Glenn	Taylor Engineering	V
											Glazer	Jason	GARD Analytics	
											Gmitter	Nick	DLB Associates	V
											Gopal	Raj	Gopal Associates	V
											Griffin	David	Etc Group, LLC	V
							X				Gu	Lixing	FSEC	V
	X		X				X		X	X	Haberl	Jeff	TAMU	CM
	X						X			X	Haddad	Kamel	NRCan	VM
							X				Han	Guiyuan	PSU	V
											Hartley	Doug	Working Buildings	V
							X		X		Haves	Philip	LBNL	CM
			X						X		Hong	Tianzhen	LBNL	
										X	Howard	Jeff	Kwhours Inc	V
			X		X		X		X	X	Huang	Joe	White Box Technologies	CM
									X		Huizar	Antonio	KW Engineering	CM
											Im	Pitjae	ORNL	V
										X	Jain	Semant	Goodman Mfg	V
							X				Javed	Hassan	Masdar, Abu Dhabi	V
	X		X		X		X		X	X	Judkoff	Ron	NREL	VM
					X						Jump	David	QUEST	CM
											Karava	Panagioton	Purdue	
					X						Kelsey	Jim	KW Engineering	
							X		X		Kennedy	Mike	Mike Kennedy Inc	
											Kennedy	John	Autodesk	

				X					Kim	Hyojin	TAMU	V
					X				Kinney	Kris	SCJenergy	CM
	X		X	X		X		X	Kolderup	Erik	Kolderup Consulting	VM
				X					Koran	Bill	Northwrite	V
	X		X	X					Kosny	Jan	Fraunhofer CSE	V
									Kota	Sandeep	Texas A&M University	
									Krarti	Moncef	University of Colorado	CM
X			X	X		X		X	Kruis	Neal	NREL	V
			X						Kummert	Michael	Polytechnique Montreal	Guest
			X						Lee	Sang Hoon	LBLN	Guest
			X						Li	Zhaoura	UTSA	Guest
			X	X				X	Lin	Cheng-Xian	Florida Int. University	CM
			X						Liu	Shichao	UT-Austin	
							X		Liu	Xoaoxing	ORNL	Guest
									Long	Nicholas	NREL	
							X		Lyons	Peter	Peter Lyons & Assoc.	V
									MacDonald	Iain	NRC Canada	CM
							X		Malherk	Elyse	McQuay	V
X		X	X	X		X			Malhotra	Mini	ORNL	CM
X		X	X	X		X		X	McDowell	Tim	TESS	VM
			X						McFadden	Galen	UTSA	Guest
									McHugh	Jonathan	MEC	V
									McNeill	James	Affiliated Engineers	
								X	Miura	Mayumi	Azbil Co.	
X		X				X		X	Muehleisen	Ralph	Argonne	CM
X		X				X			Mukhopadhyay	Jaya	ESL TAMU	V
						X		X	Nelson	Ron	IMT	CM
X		X					X	X	New	Joshua	ORNL	CM
X		X				X		X	Neymark	Joel	J. Neymark & Assoc	CM
									Ng	Lisa	NIST	
				X		X		X	O'Keefe	Michael	Big Ladder Software	V
				X				X	O'Neill	Zheng	Univ. of Alabama	CM
				X				X	Pang	Xiufeng	LBLN	CM
X				X			X		Paulus	Mitch	Texas A&M University	PCM
	X			X		X		X	Pegues	Jim	Carrier	V
									Phelan	Jerry	Bayer Material Science	V
				X					Porst	Kinga	GSA	V
			X						Premkumar	Siddarth	Gilbert Mechanical	V
X		X	X	X		X		X	Pruett	John	ZMM, Inc.	CM
				X				X	Reddy	T. Agami	Arizona State Univ	V
									Reilly	Sue	Group 14 Eng.	CM
			X	X					Roth	Amir	DOE	V
								X	Sahlin	Per	EQUA	V
			X	X		X		X	Sanyal	Jibo	ORNL	V
								X	Selin	Markus	EQUA	V
									Sharma	Chandan	FSEC	V
								X	Shrestra	Som	ORNL	CM
									Sheinman	Harris	CTT Liaison	
			X			X		X	Shirey	Don	Bentley	
									Smith	Jeremy	OSU	V
X			X	X		X		X	Snyder	Steven	Johnson Controls	
								X	Sobrevilla	Andres	Munters	
						X			Sonderegger	Robert	Itron, Inc.	CM
						X			Stovall	Therese	Oak Ridge National Labo	V
									Studer	Eric	TNZ EnergyConsulting	V
			X					X	Subbarao	Kris	PNNL	V
			X						Swartz	Keith	Energy Center of Wisconsin	V
				X					Swenka	Matt	The Weidt Group	V
								X	Tabares	Paulo	NREL	
			X	X		X		X	Taylor	Russ	UTRC	CM
								X	Trcka	Marija	UTRC	
									Ullah	Tania	NIST	
								X	Varela	Ignacio	Heatcraft	V
X									Wang	Liping	Univ. of Wyoming	V
				X					Werner	Luke	ERI	V
									West	Scott	Jacobs Engineering	V
				X		X		X	Wetter	Michael	LBLN	VM
								X	Witte	Mike	GARD Analytics	V
			X						Wong	Edmund	Arup	Guest
									Wray	Craig	LBLN	
			X						Wright	John	University of Waterloo	Guest
			x						Xiong	Zeyu	Oklahoma State Univ	V
X	X		X	X		X		X	Zuo	Wangda	University of Miami	VM
X									Luflok?	Peter	7ACTech	V
X									Xu	Ke	UTC-BIS	V
X									Oh	Suljoon	TAMU	V

Appendix 1

TC 4.7 RESEARCH PROJECTS STATUS

**ASHRAE
Technical Committee 4.7 Energy Calculations
(June 30, 2015)**

Active projects

#	Title	Joint TC	Cog SC/ Contractor	PMSC	Dates / status
1588-RP	Representative layer-by-layer descriptions for fenestration systems with specified bulk properties such as U-factor and SHGC	4.5	SCM/ White Box Technologies	Haberl	Haberl reported. Contractor doing well and proceeding. Primary tool will be using multilayer properties with EnergyPlus. Final Report in October 2015.
1629-RP	Testing and Modeling Energy Performance of Active Chilled Beam Systems	5.3	Applications/		Due for completion in May 2016

Completed projects

#	Title	Joint TC	Cog SC/ Contractor	PMSC	Dates / status
1416-RP	Development of Internal Surface Convection Correlations for Energy and Load Calculations	4.1	SCM,, Univ of Texas	Dan Fisher (Chair), Steve Bruning, Jan Kosny	Completed. Final report approved by Full Committee in Chicago Jan 24, 2012.
1404-RP	Modeling, Analysis, and Reporting Protocols for Predicting Annual Energy Performance from Short-Term Building Energy Monitoring		DDM, Milwaukee School of Engineering	R. Sonderegger (Chair) J. Haberl, V. Smith	Completed. Report approved by Full Committee in Chicago Jan 24, 2012.
1413-RP	Developing standard procedures for filing missing weather data	4.2 (lead)	Oklahoma State University		Completed.

Appendix 2
RESEARCH PLAN

ASHRAE
Technical Committee 4.7 Energy Calculations
Research Plan (July 1, 2014)

Title	Society status	TC 4.7 Status	Actors or TC 4.7 Prime Contact	Subcommittee*
Active co-sponsored projects led by another TC				
1413-RP Developing standard procedures for filing missing weather data (TC 4.2 lead)	Completed	Completed.	Chip Barnaby (member TC 4.2)	DDM
1588-RP Representative layer-by-layer descriptions for fenestration systems with specified bulk properties such as U-factor and SHGC (Co-sponsor TC 4.5)	In Progress	In Progress		SCM
1629-RP Testing and Modeling Energy Performance of Active Chilled Beam Systems (Co-sponsor tc 5.3)	In Progress	In Progress		APP
WS approved by TC				
WS under development				
1748-RP Assess and Implement Natural and Hybrid Ventilation Models in Whole-building Energy Simulations (Phase Two)	RTAR unnecessary for Phase Two	Re-writing the WS, due back to RAC by Aug 15, 2015.	Joe Huang , Simon Rees, Eric Kolderup, Malcolm Cook, Iain MacDonald	SCM
1661-RTAR Modelica Models for the Evaluation of Supervisory Control Strategies in the ASHRAE Handbook.	Sent back to authors,	Re-writing the WS, due back to RAC by Aug 15, 2015, now includes referenced to Open Source Modelica software	Wetter, Zuo	SCM
1666-WS Experimental Evaluation of the Thermal and Ventilation Performance of Stratified Air Distribution Systems Coupled with Passive Beams	Work Statement needs to be presented to TC4.7	Generated by TC 5.3 and submitted without TC 4.7 co-sponsorship	Fred Bauman	SCM
1050-RTAR Development of an Improved Inverse Model Toolkit (RP1050) and Diversity Factor Toolkit	RTAR approved by RAC in February 2015, needs WS	Haberl to provide revised WS for Orlando.	Jeff Haberl	DDM

<p>RP for supporting the ASHRAE BEQ Rating Program</p>	<p>Proposals have been submitted. They will be evaluated and a recommendation will be made in Orlando. May be awarded</p>	<p>TC 4.7 is a co-sponsor along with TC 7.6.</p>	<p>M. Brandemuehl</p>	<p>APP</p>

Appendix 3
TECHNICAL PAPERS FROM SPONSORED RESEARCH

RP	Title	Contractor	Approved	Paper
1404	ASHRAE RP1404 <i>- Measurement, Modeling, Analysis and Reporting Protocols for Short-term M&V of Whole Building Energy Performance</i>	MSOE-ASU	Louisville June 2009	Singh, Reddy, Abushaka 2013 “Predicting Annual Energy Use in Buildings Using Short-Term Monitoring and Utility Bills: The Hybrid Inverse Model Using Daily Data (HIM-D)”
1404	ASHRAE RP1404 <i>- Measurement, Modeling, Analysis and Reporting Protocols for Short-term M&V of Whole Building Energy Performance</i>	MSOE-ASU	Louisville June 2009	Singh, Reddy, Abushaka 2014 “Predicting Annual Energy Use in Buildings Using Short-Term Monitoring: The Dry-Bulb Temperature Analysis (DBTA) Method”
1051	Procedures for Reconciling Computer-calculated Results with Measured Energy Data	Drexel	Chicago January 2006	Reddy, T.A., 2006. "Literature Review on Calibration of Building Energy Simulation Programs: Uses, Problems, Procedures, Uncertainty and Tools", ASHRAE Transactions, vol 112(1).
1051	Procedures for Reconciling Computer-calculated Results with Measured Energy Data	Drexel	Chicago January 2006	Sun J. and Reddy T.A., 2006, "Calibration of Building Energy Simulation Programs Using the Analytic Optimization Approach (RP-1051)", Int. J HVAC&R Research 12(1) 177-196.
1051	Procedures for Reconciling Computer-calculated Results with Measured Energy Data	Drexel	Chicago January 2006	Reddy, T.A., I. Maor and C. Ponjapornpon, 2006, "Calibrating Detailed Building Energy Simulation Programs with Measured Data- Part I: General Methodology", accepted for publication in Int. J HVAC&R Research.
1051	Procedures for Reconciling Computer-calculated Results	Drexel	Chicago January 2006	Reddy, T.A., I. Maor and C. Ponjapornpon, 2006, "Calibrating

	with Measured Energy Data			Detailed Building Energy Simulation Programs with Measured Data- Part II: Application to Three Case Study Office Buildings", accepted for publication in Int. J HVAC&R Research.
1050	Development of an Inverse Model Toolkit	Univ. of Dayton, Texas A&M	December 2001	Kissock, K., Haberl, J., Claridge, D. 2003. "Inverse Model Toolkit (1050-RP): Numerical Algorithms for Best-Fit Variable-Base Degree-Day and Change-Point Models," ASHRAE Transactions-Research, Vol. 109, Pt. 2, pp. 425 – 434.
865	Accuracy Tests for Simulations of VAV Dual Duct, Single Zone, Four Pipe Fan Coil and Four Pipe Induction Air Handling Systems (4796)	Univ Nebraska, Texas A&M	July 2002	Yuill, G., Haberl, J. 2006. "Accuracy Tests for Simulations of VAV Dual Duct, Single Zone, Four Pipe Fan Coil and Four Pipe Induction Air Handling Systems (4796)," ASHRAE Transactions-Research, Vol. 112, Pt. 1 (January).
865	Accuracy Tests for Simulations of Constant Volume, Dual Duct and Variable Volume Air Handling Systems (4796).	Univ. Nebraska, Texas A&M	July 2002	Yuill, G., Haberl, J., Caldwell, J. S. 2005. "Accuracy Tests for Simulations of Constant Volume, Dual Duct and Variable Volume Air Handling Systems (4796, RP-865)," ASHRAE Transactions-Research, Vol. 111, Pt. 2, No. 4796, pp. 137 – 153 (June).

Appendix 3 (continued)
TECHNICAL PAPERS FROM SPONSORED RESEARCH

1050	Development of an Inverse Model Toolkit	Univ. of Dayton, Texas A&M	December 2001	Kissock, K., Haberl, J., Claridge, D. 2003. "Inverse Model Toolkit (1050-RP): Numerical Algorithms for Best-Fit Variable-Base Degree-Day and Change-Point Models," ASHRAE Transactions-Research, Vol. 109, Pt. 2, pp. 425 – 434.
1050	Development of an Inverse Model Toolkit	Univ. of Dayton, Texas A&M	December 2001	Haberl, J., Claridge, D., Kissock, K. 2003. "Inverse Model Toolkit (1050-RP): Application and Testing," ASHRAE Transactions-Research, Vol. 109, Pt. 2, pp. 435 – 448.
1093	Diversity Factors and Schedules for Energy and Cooling Load Calculations	Texas A&M	June 2000	Abushakra, B., Haberl, J., Claridge, D. 2004. "Overview of Literature on Diversity Factors and Schedules for Energy and Cooling Load Calculations (1093-RP)," ASHRAE Transactions-Research, Vol. 110, Pt. 1 (February), pp. 164 – 176.
1093	Diversity Factors and Schedules for Energy and Cooling Load Calculations	Texas A&M	June 2000	Claridge, D., Abushakra, B., Haberl, J. 2003. "Electricity Diversity Profiles for Energy Simulation of Office Buildings (1093-RP)," ASHRAE Transactions-Research, Vol. 110, Pt. 1, pp. 365 – 377 (February).

Appendix 4

Atlanta Summer Meeting TC/TG/TRG SPONSORED SEMINARS

PRESENT:

Tuesday 11:00 AM-12:00 AM

Seminary 48

Model Predictive Control: Application to Chilled Water Plants and Radiant Slab Cooling

Room: 204/205

PLANNED:

Orlando

Seminar 59: Simulation Calibration Methods: Which Should I Choose?

Seminar 67: Simulation for Cutting-Edge Building Design

Workshop 2: ASHRAE Standard 205P: Better Data, Better Models, Better Results

MINUTES
ASHRAE TC 4.7 Energy Calculations – Main Meeting
Atlanta, GA
Tuesday, June 30, 2015, 6:00-8:30 pm

Minutes (recorded by Bass Abushakra)

1. **Roll Call** at 6:10 pm, 7 Voting Members present. 3 Voting Members are rolling off after Atlanta (Abushakra, Fisher, Wetter). 2 Corresponding Members are rolling on after Atlanta (Crawly, Haberl). See Roster for attendance.
2. **Minutes** from Chicago reviewed. Kolderup moved, Judkoff seconded to approve the Minutes 6 – 0 – 0-CNV Motion passes.

3. Announcements/Liaisons:

New standard MOT to determine heat gains from office equipment was released.
Upcoming workshops and conferences:
IBPSA World - Hyderabad.

4. Membership: 12 voting members, 7 present, 5 absent

Present: Abushakra, Haddad, Huang, Judkoff, Kolderup, Kruis, Zuo.
Absent: Balbach, Cockerham, Cook, Fisher, Wetter.

5. Subcommittee Reports:

5.1 Applications (Judkoff):

Program: 2 seminars for Orlando (Calibration 2.0; Technology Performance Exchange and building component library). 2 papers accepted and will be presented in St. Louis, 1 for St Louis (Standard 209).
RTAR's: 1 written.

5.2 DDM (Muehleisen):

19 people were present. Discussed program. Calibration seminar (with Applications) for Orlando.
WS: Based on Jeff Haberl's RTAR (updating the Toolkit). Discussion between Haberl and Jump to form a new RTAR. Handbook chapter should be updated with RP-1404 materials.

5.3 SCM (Crawley):

Discussion on WS in program. One of 1666 submitted without TC4.7 as a co-sponsor.
WS on Data-Centers was discussed; TC9.9 did not approve
WS-1661 should be resubmitted by Aug 15, otherwise it would be dropped
WS-1748 revised version was circulated. Comments by Sep 1st.

5.4 Research (Haberl):

5.4.1 RP's:

TRP-1588 Bulk window properties. Contractor is making good progress. Primary tool will be using multilayer properties with EnergyPlus. Final Report due in October 2015.

TRP-1629: Test Chamber on Chilled Beam on track due for completion in May 2016.

5.4.2 WS's, RTAR's:

WS-1661 rewriting the WS due back to RAC by Aug 15.

WS-1748 rewriting the WS due back to RAC by Aug 15.

RTAR-1763 (from DDM), approved by RAC with comments. (based on a redo of RP-1550)

865 Toolkit possible RTAR. Talks about adding new models.

Additional Material:

- RAC: has developed now “staged-funding and project monitoring”. It’s a process about writing WS with tasks associated with budget items. Contractors will be judged on the milestones of the project.
- Shift in the ASHRAE Strategic Plan. Initiative 5. Initiative 1-B (methods on measuring rather than estimating).
- There is a webbased training launched in June 2016 to write RTAR's and WS's, PES committee, and PMS committee.
- What does 4.7 does than makes a difference (Guideline 14-2014): research getting out for the users.

5.5 Handbook:

Chapter 19 of HoF (2017). June 21 2016 is the deadline for full TC to approve the revision. We have an outline for proposed changes. The handbook subcommittee will meet online to deliberate between now and January.

5.6 Program:

Orlando:

4 Seminars and 1 Workshop: Seminar on Calibration (DDM); Seminar on technology performance (SCM);

St. Louis:

Seminar Standard 209, Paper Session (3 papers on history of HVAC, daylighting simulation)

Motion to approve the Program by Judkoff, Kolderup seconded motion to approve the program(6-0-0-CNV).

5.7 Standards:

5.7.1 SSPC 140 SMOT

Standard Method of Test for the Evaluation of Building Energy Analysis Computer Programs.

- This is the 25th anniversary of the Std 140 committee; PC founded in 1990.
- Current IRS rules (IRS notice 2008-40, published Apr 2008) relating to the deduction for energy efficient commercial buildings require software used for assessing tax credits be tested to Standard 140-2007. Currently 13 programs are qualified; 8 programs qualified updated versions. (Last check 22Jun2015). New submittals ron.judkoff@nrel.gov
Qualified programs listed at <http://energy.gov/eere/buildings/qualified-software-calculating-commercial-building-tax-deductions>
- RESNET lists 8 (up from 6, last check 22 Jun2015) tools as either accredited for HERS ratings, tax credit compliance, IECC performance verification, or existing home tax credit compliance. Required tests include NREL's HERS BESTEST (included in Std 140-2011,-2014), along with equipment modeling and other modeling tests developed by RESNET. New submittals to RESNET (<http://www.resnet.us/professional/programs/software>).
- ASHRAE 90.1 and 189.1 reference Standard 140;
 - 90.1-2013, published Fall 2013 updated their reference to 140-2011.
- 2015 IECC cites 140-2011; IGCC citation accords with IECC.

Standard 140-2014 Continuous Maintenance Revision Published:

- Adds ground-coupled slab analytical verification tests to 140-2011 tests.
- SSPC 140 agreed on continuous maintenance proposal to submit to SSPC 90.1, to update their reference from "140-2011" to 140-2014". Neymark to submit asap.

Proposed Addendum A to 140-2014. (ASHRAE RP-865 Airside-Mechanical Equipment tests adaptation):

- Test suite based on ASHRAE RP-865; first 140 suite based on ASHRAE research.
- Airside analysis of Fan Coil (FC), Single Zone (SZ), Constant Volume (CV), and Variable Air Volume (VAV) systems.
 - These are steady-state analytical verification tests.
 - Provides basis for future Volume 2 test suite with hourly varying weather, and other steps toward testing performance in more realistic (less idealized/in-depth-diagnostic) context.
- Robust participation: 7 simulation trial participants from 4 countries + Quasi-Analytical Solution by NREL.
- Planning for NREL final report during late2015/early2016.
- Standard 140 adaptation during 2016.

5.7.2 SPC 205:

Standard on Component description performance data that is written by manufacturers to be used by the simulation community. A very good draft is written. Public Review will start and comments will be deemed supported. Body of the standard is a representation specification (Chillers, Unitary AC, and Fans). Pumps, VRF's and Water Heater are still in the brainstorming stage. Electronic supporting data will be put online for users not only ASHRAE Members without passwords, but definitely would need official approval.

5.7.3 SPC 209:

Jason Glazer is the chair of the committee Building Energy Simulation for the design process, a draft will be put out for public review. Modeling cycles are presented, from a box model before schematic design, to the operation phase falling short of doing a calibration. The standard should (would) recommend methods from Guideline 14, because the standard recommends doing regression between energy use and outdoor temperature.

5.7.4 Standard 214:

Attempt to standardize rating programs.

5.7.5 SPC 189.1:

IGCC will be the only standard used in the US. It is actually Standard 189.1 one you open IGCC.

5.8 Website:

tc47.org is the address and is linked to ashrae.org. The website is working better than before.

6. Related Activities:

SPC 191 water conservation is reorganizing and has a new Chair, after stalling for a while

MTG EAS: Energy Efficient Air Handling System

SGPC 20 - MTG BIM: (Chip) An interest in formalize ASHRAE type data to put in BIM object. From Guideline 20, How to write a use case and take it to MTG BIM.

TC 2.8: No input from attendance.

TC 4.1: No input from attendance.

TC 4.2: (Dru) is updating the data for the handbook. Concluded a project to adjust data for elevation and location. Discussion on All-Sky data and not only Clear-Sky data.

TC 4.3: No input from attendance.

TC 4.5: No input from attendance.

TC 6.5: No input from attendance.

TC 7.5: (Haberl) Smart meters had presentations in this conference, and used for dynamic simulations, to help utilities aggregate and forecast energy for neighborhoods.

TC 7.6: (Haberl) revisiting Confidence Intervals in Guideline 14. Maybe develop an RTAR on that topic.

Building SMART: (Chip) MTG BIM is connected with this.

IBPSA: (Chip) USA. Josh was a speaker during the Atlanta dinner. Discussion on teaming with ASHRAE 2016 Energy conference. Joe Huang will lead a steering committee for that conference. (Kolderup) talked about Students Travel Grants up to 8 (information is found ibpsa.us). Digital copies of historic material. Scanned proceedings and uploaded to the IBPSA-USA website.

IBPSA-Canada 2016 conference.

IBPSA-World Simulation conference 2015 papers are already received and ready for review.

Building Simulation 2017 (international conference). Phil Haves, Eric Kolderup and Chip Barnaby are organizing it. It will be held in San Francisco.

BPI-2400-S-2011: No input from attendance.

Guideline 14: 2014 edition is out. It has one Errata. Available from ASHRAE. Within a year a committee work will start on the next edition

IEA Annex 60: (Wangda) Modelica work between US and Europe. Open-source tools to the public. Users will be able to connect components from different libraries.

IEA Annex 66: (Wangda) will meet in August in Germany. The work is Occupant Behavior.

ASHRAE Historical Committee:

Were did the load calculations come from, solar, daylighting sources. Building Simulations will be a part of the work on the ASHRAE historical committee. Were did the work come from, who did it.

Other:

Inverse Model Toolkit is now used in the Navy to baseline their fleet.

7. **Old Business:** No input from attendance.
8. **New Business:** No input from attendance.
9. **Executive Session:** No input from attendance.
10. **Adjourn:** Motion by Kruis seconded by Judkoff to adjourn. Meeting Adjourned at 8:04 pm.

Attachments

- A. Agenda
- B. Simulations and Component Models Subcommittee Agenda and Minutes
- C. Data-Driven Models Subcommittee Agenda and Minutes
- D. Applications Agenda and Minutes
- E. Handbook Subcommittee Agenda and Minutes
- F. SSPC 140 Agenda and Minutes

Attachment A

Agenda ASHRAE TC 4.7 Energy Calculations – Main Meeting Salon C, Atlanta Hilton, Atlanta, Georgia Tuesday, June 30, 2015, 6:00-8:30 pm

1. Roll call and introductions (5 minutes) Balbach
2. Accept agenda & approve minutes of previous meeting (10 minutes) Huang
3. Announcements/Liaisons (5 minutes) Huang
4. Membership (5 minutes) Huang
5. Subcommittee reports
 - 5.1 Applications (10 minutes) Judkoff
 - 5.2 Data-Driven Modeling (10 minutes) Muehlissen
 - 5.3 Simulation and Component Models (10 minutes) Crawley
 - 5.4 Research (15 minutes) Haberl
 - 5.4.1 Research Projects
 - 1588-RP Representative Layer-by-Layer Descriptions for Fenestration Systems with Specified Bulk Properties Such as U-factor and SHGC (co-sponsored with TC 4.5)
 - 1629-RP Testing and Modeling Energy Performance of Active Chilled Beam Systems (co-sponsored with TC 5.3) (completed ?)
 - 5.4.2 Workstatements, RTARs, Requests for Co-sponsorship
 - 1661-RTAR Modelica Models for the Evaluation of Supervisory Control Strategies in the ASHRAE Handbook (sent back to Authors) – SCM (contact Wangda Zuo for status)
 - 1748-RTAR Assess and Implement Natural and Hybrid Ventilation Models in Whole-building Energy Simulations (Phase 2) – SCM (Tony says he will be sending a draft this week YJH)
 - 1666-WS Experimental Evaluation of the Thermal and Ventilation Performance of Stratified Air Distribution Systems Coupled with Passive Beams – (request for co-sponsorship by TC 5.3) (status ?)
 - XXXX-RTAR Development of an Improved Inverse Model Toolkit (RP1050) and Diversity Factor Toolkit (RP1093) for Analyzing Building Energy Savings from Time Series Data.
 - Requests for co-sponsorship
 - 5.5 Handbook (10 minutes) Kolderup
 - 5.6 Program (15 minutes) Cockerham
 - 5.7 Standards (15 minutes) Neymark
 - SSPC 140 SMOT for Eval Bldg Energy Analysis Computer Programs Neymark
 - SPC 205 – Std. Representation of Perf. Sim. Data for HVAC&R & Other Fac'l Equipment Barnaby
 - SPC 209 Energy Simulation Aided Design Glazer
 - 5.8 Web Site (5 minutes) New
6. Related activities reports (15 minutes)
 - SPC 191 Water Conservation
 - MTG.EAS Energy Eff AHU Systems
 - MTG.BIM Building Information Modeling
 - SGPC 20 Documenting HVAC&R Work Process and Data Exchange Requirements
 - TC 2.8 Building Environmental Impacts and Sustainability
 - TC 4.1 Load Calculation Data and Procedures
 - TC 4.2 Climatic Information
 - TC 4.3 Infiltration & Ventilation Requirements
 - TC 4.5 Fenestration
 - TC 6.5 Radiant Heating and Cooling
 - TC 7.5 Smart Building Systems (now includes TC 7.4)
 - TC 7.6 Building Energy Performance
 - BuildingSMART (formerly IAI International Alliance for Interoperability)
 - IBPSA: USA, Canada, World
 - BPI-2400-S-2011 Standardization Qualification of Whole-house Energy Savings Est. Guideline 14
 - IEA Annex 60
 - IEA Annex 66
 - ASHRAE Historical Committee
7. Old Business Huang
8. New business Huang
9. Executive Session Huang
10. Adjourn Huang

Note TC 4.7 Email list hosted at onebuilding.com

Attachment B

Agenda:



Draft Agenda

TC 4.7 Simulation and Component Models Subcommittee

6:00-7:30 pm, Monday, 29 June 2015

Crystal C/D, Lobby, Atlanta Hilton
Atlanta, Georgia

-
- 6:00 Call to order / introductions / changes to the agenda Crawley
- 6:10 **Research Projects**
- **1629-RP** Testing and Modeling Energy Performance of Active Chilled Beam Systems (TC 5.3 / TC 4.7)
- 6:20 **Draft Work Statements/RTARs**
- **1666-WS** Experimental Evaluation of the Thermal and Ventilation Performance of Stratified Air Distribution Systems Coupled with Passive Beams (TC 5.3 Room Air Distribution, requesting TC 4.7 co-sponsor) Bauman, Zimmerman
 - **17xx-WS** Development of Improved and Integrated Energy Modeling Software for Data Centers (TC 9.9 / SPC 90.4P / TC 4.7) Amistadi, Davidson
 - **17xx-WS** Development of a Reference Building Information Model (BIM) for Daylighting Optimization (TC 1.5 / TC 4.7) Haberl
 - **1661-WS** Development and Validation of Dynamic Models for the Evaluation of Chilled-Water Systems Control Strategies in the ASHRAE Handbook (TC 4.7/ TC 7.5 / TC 1.4) Wangda/Wetter
 - **1748-WS** Assess and Implement Natural and Hybrid Ventilation Models in Whole-Building Energy Simulations – Phase 2 (TC 4.7 / TC 4.10) Fontanini/Huang
- 6:50 **New Research Topics/Research Plan**
- New Research Topics (RTARs and WSs can be submitted 4 times a year—six weeks before Winter and Annual meetings and 1 March/1 August.)
 - Several new research topics at last meeting:
 - Research for new ground heat transfer tables in the HOF (Kruis)
 - Research for better simulations for occupants (Hong)
 - Better hygrothermal modeling for highly efficient buildings, including VOC issues, etc. Current project supported by the IEA (Rode).
 - Mixed mode / ventilation
- 7:20 **Program Ideas**
- 2016 Winter (Orlando), 2016 Annual (St. Louis), 2017 Winter (Las Vegas)
- 7:25 **New Business**
- 7:30 **Adjourn**
-

Next Meeting: Monday, January 25, 2016 Orlando, Florida

Meeting Minutes:



Draft Minutes

TC 4.7 Simulation and Component Models Subcommittee

6:00-7:30 pm, Monday, 29 June 2015

Crystal C/D, Lobby, Atlanta Hilton
Atlanta, Georgia

Call to order / introductions / changes to the agenda

Crawley

Research Projects

- **1629-RP** Testing and Modeling Energy Performance of Active Chilled Beam Systems
No report on status. Project was due to be completed in May 2016 (TC 5.3 / TC 4.7)

Draft Work Statements/RTARs

- **1666-WS** Experimental Evaluation of the Thermal and Ventilation Performance of Stratified Air Distribution Systems Coupled with Passive Beams (TC 5.3 Room Air Distribution, requesting TC 4.7 co-sponsor) Bauman, Zimmerman
TC 5.3 submitted the work statement to RAC but did not request that TC 4.7 co-sponsor.
- **17xx-WS** Development of Improved and Integrated Energy Modeling Software for Data Centers (TC 9.9 / SPC 90.4P / TC 4.7) ~~Amistadi~~, Davidson
This draft work statement was put on hold by TC 9.9. Will bring the topic back to the meeting in Orlando.
- **17xx-WS** Development of a Reference Building Information Model (BIM) for Daylighting Optimization (TC 1.5 / TC 4.7) Haberl
This draft work statement has fallen off the research plan, no progress.
- **1661-WS** Development and Validation of Dynamic Models for the Evaluation of Chilled-Water Systems Control Strategies in the ASHRAE Handbook (TC 4.7/ TC 7.5 / TC 1.4)
Have received some feedback on the draft work statement. Working to have draft work statement for the TC meeting on Tuesday for possible TC approval.
~~Wangda/Wetter~~
- **1748-WS** Assess and Implement Natural and Hybrid Ventilation Models in Whole-Building Energy Simulations – Phase 2 (TC 4.7 / TC 4.10) Fontanini/Huang
Revised version circulated at ~~subc~~ (based on comments at last meeting). S&CM ~~subc~~ to provide comments to Tony by 1 Sept.

New Research Topics/Research Plan

- Several new research topics discussed:

PC Thomas ... idea for new research on coils, higher latent loads not covered by current coil models. PC to circulate RTAR by end of September

Haberl/Huang... updating the HVAC 01 and 02 Toolkits. Jeff and Joe ... to circulate by end of September.

Program Ideas

Chris Balbach talked about program opportunities, tracks related to TC 4.7 for upcoming meetings in Orlando, St Louis.



Attachment C Draft Agenda and Minutes

TC 4.7 Data Driven Models Subcommittee Meeting 6:00 – 7:30 pm, Monday, January 26, 2015 Monroe, 6th Floor,, Palmer House Chicago, IL



TC4.7 Data-Driven Models Subcommittee Monday June 29, 2015, 7:30–9:00 PM

Location: Atlanta Hilton, Crystal CD, 1st Floor

Agenda:

7:30 Call to order / Introductions / Changes to the agenda

Attendees: Ralph Muehleisen, Jeff Haberl, Ron Judkoff, Chris Balbach, Joe Huang, Jaya Mukhopadhyay, Amir Roth, Bass Abushakra, Clinton Davis, Mitchell Paulus, Jim Spielbauer, Peter Armstrong, Peter Luttk, Anthony Fontanini, Zulfikar Cumali, Sukjoo Oh, Mini Malhotra, Kris Kinney

7:40 Discussion of Program (10 minutes)

- Summer Meeting 2015 (Atlanta) Review
- Winter Meeting 2016 (Orlando)

Tracks of interest:

- Track 6 Cutting Edge Technologies: creative ways to improve efficiencies in the effort to achieve net zero buildings
- Track 7: The Great Debate: sessions present divergent methods for accomplishing the same task

Ron Judkoff had interest in presenting Resnet/ANSI calibration validation work. Committee decided that a Calibration 2.0 session with 2 or 3 different methods of calibration, ended with Ron presenting the MOT would fit Track 7. Jaya Mukhopadhyay to chair session.

Seminar Ideas: M&V / Whole Building DDM?

- 2015 ASHRAE Energy Modeling Conference (Atlanta)
(no program discussion – just info/announcement)

- Summer Meeting 2016 (St. Louis)

Tracks of Interest:

- Track 5: Smart Building Systems / Remote Monitoring and Diagnostics
- Track 8: Renewable Energy Systems and Net Zero Buildings

Conference Paper or Seminar Ideas

- DDM related to monitoring and diagnostics?

Chris B. Announced that deadlines for conference paper session submission for St. Louis was mid Sep.
No specific session discussions for St. Louis

8:00: Work Statements / RTAR's (50 minutes)

- Existing WS and RTAR's
 - Haberl: Inverse Modeling Tool Update RTAR "Development of an Improved Inverse Model Toolkit (IMT) for Analyzing Building Energy Savings from Time Series Data" (RP 1050)

Jeff H: RTAR 1763 for 1050 (IMT) +1093 (diversity toolkit) update has gone up to RAC and returned with comments.

Jeff said there were several comments important for others considering writing an RTAR:

- statements need to be clear on deliverables for enforcing contracts
- Statement of why this is needed and different from other commercial offerings might be similar
- Question of how many users of the previous toolkit.
- How is this software going to be maintained in the future.

- Data Driven Schedules? (David Bosworth, Ralph Muehleisen)

Muehleisen said nothing has been done but he's still interested and he will follow up with D. Bosworth before next meeting and he will talk with Tienzhen Hong who has been doing related work with Annex 66
Amir Roth said to check with Buchi Chaudary of U. Cambridge. Ron J. says to check also with Da Yan of Tsingua (working on Annex 66) to see where they are before starting any work.
Jeff Haberl says to look at the diversity factor toolkit and planned redo thereof in RTAR to see what overlap there is with this possible research project.

- o Inverse Modeling Test Scheme / Standards? (Chris Balbach)

- o David Jump idea from NY: Develop and test a methodology to validate public domain and proprietary energy baseline modeling capabilities well as savings estimation using inverse modeling methods on whole building data. The goal is to create a **method of test of inverse models**

Joe Huang mentioned that David Jump was emailing he and Jeff Haberl about this and sent a one-pager to Jeff Hand Joe H. Jeff was helping him. Muehleisen will look over this and will follow up with Jeff J and David Jump. Muehleisen was directed to pester Jeff H. to make sure this goes somewhere

There was a fairly long discussion about the topic relating to the general idea. Discussion points included

- What sorts of data would be used?
- Could this be done with variations of the validation MOT?
- Could we do this with synthetic data done via simulation?
- Do we want to do another shootout? (Haberl says it's a *LOT* of work)

8:45: Handbook Contributions

- Looking for volunteers to update/review relevant sections of Fundamentals Chapter related to DDM
 - o Table 1
 - o Fundamentals 19.22-19.28
 - Add Machine learning other than ANN?
 - Add non-parametric regression techniques (Gaussian Process or Kriging models)?

Muehleisen says that DDM section is fairly long but focused on simple regression methods. This could be trimmed to expand the section to more advanced methods including new machine learning and non-parametric regression).

Bass A. is interested in being part of any revisions.

Jeff H. says current table is a mishmash, needs updating
Dynamic and static methods, forward and inverse are all mixed up.

TC 7.5 is not addressing MPC, should it be here? Peter Armstrong volunteers to look at this.

Muehleisen will try to coordinate efforts between DDM subcommittee and 4.7 handbook chair Kolderup.
Muehleisen will pester people to get stuff done related to DDM.

8:55 New Business

No New Business

9:00 Adjourn

Meeting Adjourned at 8:30



Attachment D Draft Agenda and Minutes

TC 4.7 Applications Subcommittee Meeting 6:00 – 7:30 pm, Monday, January 26, 2015 Monroe, 6th Floor,, Palmer House Chicago, IL

TC 4.7 Applications subcommittee Meeting Minutes: 6/30/15: Atlanta

3:33pm: Ron Judkoff, Chair, called to order.

Agenda and minutes from Chicago Winter meeting (Jan 2015) circulated a few days ago.

Announcements:

- ASHRAE Call for papers for St Louis (Summer 2016)(see attachment)
- Proposed changes to TC-5.2 Title Purpose & Scope, from to "Design system". Bass briefed the progress. Maybe Craig Ray can report more details in full committee meeting. (see attachment).
- TC 4.1 new ASHRAE/ANSI Standard 203-2014, "Method of Test for Determining Heat Gain of Office Equipment Used in Buildings". Joe Huang circulated the copy of the standard (see attachment).

Program:

Keith Cockerham not present, and Chris Balbach called away by family emergency so reported by Joe Huang.

Orlando Conference:

- Wangda Zuo: Seminar: Use of Simulation Tools for Cutting Edge building design. speakers: Arpan Bakshi (SOM), Jeff Boyer (dbHMS), Wangda Zuo (Miami)
- Wangda Zuo: High Performance Computing for buildings. Speakers: David Bosworth (BUILDLab), Nathaniel Jones (MIT), Jon Hand (ESRU, UK), Neal Kruis
- Tim: Resubmit a seminar about Standard 205.

St. Louis Conference:

- Jeff Haberl mentioned two recent accepted papers for Orlando conference and a third almost accepted, but will have to wait until St. Louis because of timing. Need to figure out which format the paper will be presented. Jeff will contact the CEC that TC is willing to package a seminar which CEC tends to like because it makes it easy for them.
- Eric mentioned that Standard 209 can be presented. To be discussed in Orlando.

Research:

- Eric Kolderup updated the activity in BEMBook, RMI working on it (Ellen Franconi). IBPSA-USA will host it on line. Discussed the possibility of TC 4.7's involvement. No conclusion yet.
- Eric Kolderup Updated the activity on SPC209. It hasn't been voted out for public review yet, but it is mostly done, and will likely be voted out at the next Winter meeting. 209 requires at

least two cycles of modeling and a design charrette. 209 recommends modeling throughout the design process, but only requires that a subset of the recommendations be implemented for compliance with 209. Judkoff asked if 209 required simulation in the early design phase when it can really make a difference on the energy use of the building. Early simulation is encouraged but not required in the standard. The SPC209 will be ready for public review when the entire standard is drafted (targeted Jan 2016).

- Jeff Haberl mentioned that 209 [references](#) and the Diversity Factor Toolkit.

Ideas for New RTARs:

- Guidelines on simulating tall buildings (Joe Huang), no new update.
- Reconciling differences between simulation results and actual energy use (Joe Huang, Son [XXXX](#) from ORNL); Jeff Haberl and Neal Krus volunteered to review. Danny Parker from FSEC is measuring the building energy consumption in 60 houses in Florida and the data is public on a website. Joe Huang suggested that we can model the buildings using their data and see how well the model matches the dynamics. The data can be used for various purposes. Need to review the data for their availability and resolution.
- Comparing ASHRAE 90.1 App G Models to Real Buildings (Joe Huang). Nothing new to report.
- How to process, convert, or modify weather files for use in energy [simulations](#). (Jeff Haberl), nothing new to report.
- Liping Wang presented an RTAR “Optimizing change-over mixed-mode cooling systems for houses using building simulation” (this led to lots of discussion).
 - Requirements need to be specific for bidder selection
 - Need to address the value to ASHRAE
 - Joe mentioned that DOE-2 has the feature of automatic switching between the natural and mechanical ventilation, and does this in a near optimal way, but EnergyPlus doesn't do this.
 - Some ideas: Comparison of different tools for mixed-mode ventilation
 - Consider both energy savings and comfort from air movement around occupants
 - EnergyPlus outputs velocity profiles
 - Jeff Haberl, Kamal Haddad, and Liping will revise the RTAR.
- Neal Krus will work on an RTAR to update the ASHRAE F and C ground coupling factors. (Put on the agenda for next meeting)

Attachment 1

TC 4.7 Applications Subcommittee

Agenda

Atlanta

Tuesday, 30 June 2015

3:30-5:00pm Atlanta Hilton: Salon C (2)

- 1) Introductions and Agenda Review (5 minutes)
 - a. Sign-up sheet
 - b. Around Room
 - c. Agenda Mods

- 2) Announcements (5 minutes)
 - a. ASHRAE Call for papers for St Louis (Summer 2016)
 - b. Proposed changes to TC-5.2 Title Purpose & Scope, "Duct Design".
 - c. TC 4.1 new ASHRAE/ANSI Standard 203-2014, "Method of Test for Determining Heat Gain of Office Equipment Used in Buildings"

- 3) Program (15 minutes) (Keith Cockerham)
 - a. 2015 Summer (Atlanta)
 - b. 2016 Winter (Orlando)
 - c. 2016 Summer (St. Louis, MO)
 - d. 2017 Winter (Las Vegas)

- 4) Research (65 minutes)
 - a. Updates on related activities (10 minutes each)
 - Update on BEMBook and other COMNET-related activities (Ellen Franconi)
 - Update on SPC209P, *Energy Simulation Aided Design for Buildings Except Low-Rise Residential Buildings* (Jason Glazer, if available)

- Ideas for new RTARS (15 minutes each)
 - Guidelines on simulating tall buildings (Joe Huang)
 - Reconciling differences between simulation results and actual energy use (Joe Huang)
 - Comparing ASHRAE 90.1 App G Models to Real Buildings (Joe Huang)
 - How to process, convert, or modify weather files for use in energy simulations (Jeff Haberl)
 - Others?
- Topics for discussion (whatever time remains)
 - Should TC 4.7 maintain a set of prototypical building models and input files, possibly building on DOE's "Reference Building Models"?
 - Any other issues or concerns (does not have to be turned into an RTAR or WS).
 - Emphasis and Focus of Future Applications Subcommittee Meetings and Activities

ATTACHMENT 2

<u>Bass Abushakra</u>	MSOE	abushakr@msoe.edu
<u>Wangda Zuo</u>	U of Miami	w.zuo@miami.edu
<u>Anthony Fontanini</u>	Iowa State U	fontania@iastate.edu
<u>Liping Wang</u>	U. Wyoming	Lwang12@wyo.edu
<u>Ralph Muelheisen</u>	ANL	rmuelheisen@anl.gov
<u>Kris Kinney</u>	KECG	kinneyecg@gmail.com
<u>Joe Huang</u>	White Box Technologies Inc.	yjhuang@whiteboxtechnologies.com
<u>Mitchell Paulus</u>	Texas A&M	Paulusm14@gmail.com
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Neil Kruis	Big Ladder Software	neilkruis@bigladdersoftware.com
Tim McDowell	TESS	mcdowell@tess-inc.com
Mini Malhotra	ORNL	malhotram@ornl.gov
Jeff Haberl	TAMU	jhaberl@tamu.edu

ATTACHMENT 3

ASHRAE has announced a call for papers for its 2016 Annual Conference, which takes place June 25-29 in St. Louis, Mo.

To submit a Conference paper abstract or a technical paper and for more information about the conference, go to www.ashrae.org/stlouis.

“The 2016 Annual Conference Technical Program features a great mix of the engineering basics as well as advanced systems and professional development,” Wade [Conlan](#), chair of ASHRAE’s Conferences and Expositions Committee, which oversees the Conference, said. “Among the eight tracks are two that will push boundaries: Smart Building Systems as well as Renewable Energy Systems and Net Zero Buildings. And we are going back to the core of air conditioning with a track on Advances in Refrigeration Systems and Alternative Refrigerants.”

Papers are sought for the following tracks: Advances in Refrigeration Systems and Alternative Refrigerants; Fundamentals and Applications; HVAC Systems and Equipment; Smart Building Systems/Remote Monitoring and Diagnostics; Indoor Environment: Health, Comfort, Productivity; Professional Skills [Beyond Engineering](#); and Renewable Energy Systems and Net Zero Buildings. Papers also are sought for the fourth annual Research Summit, which reports results on any aspect of ASHRAE-related research.

Authors have two options to prepare their papers:

Conference Papers: Abstracts due Sept. 14, 2015. Upon acceptance, papers will be due Jan. 4, 2016. These “final” papers undergo a single-blind review, are submitted as a PDF and have an eight single-spaced page maximum length.

Full Technical Papers, which are due Sept. 14, 2015. Papers submitted for review must be both technically accurate and clearly written. These papers undergo a rigorous double-blind review and can be a maximum of 30 double-spaced pages.

ASHRAE authors enjoy benefits that include:

- No publication charges
- Interaction with other researchers
- Reduced Conference registration (\$105)
- Technical Papers published in ASHRAE Transactions
- Conference Papers published in the 2016 ASHRAE Annual Conference — Papers (download)

ATTACHMENT 4

Proposed Changes to TC 5.2 Title and Scope

May 2015

ORIGINAL

Title: Duct Design

Technical Committee 5.2 is concerned with the design, characteristics, and construction of all types of ductwork for the handling of air and other gases, but does not include chimneys.

PROPOSED WORDING – WITH CHANGES OVERLAID

Title: Duct Design Systems

Scope: Technical Committee 5.2 is concerned with the design, construction, and operating characteristics, and construction of ductwork duct systems for the handling air and other gases, but does not include chimneys. This includes consideration of duct system materials and sizes, air velocities, and air leakage, as well as pressure changes and energy use related to ducted flows.



Re Bldg-sim
Comparing ASHRAE 9

|

ATTACHMENT 5

TC 4.7 members,

I'm forwarding this announcement from Glenn Friedman of TC 4.1 concerning the new

ASHRAE/ANSI Standard 203-2014, "Method of Test for Determining Heat Gain of Office Equipment Used in Buildings", which should be of equal interest to TC 4.7 for use in building energy simulations. It might be worthwhile for TC 4.7 members to review this new standard, and see whether the MOT is equally appropriate for determining equipment heat gain for annual simulations.

I look forward to seeing everyone in Atlanta in less than two weeks.

Joe
TC 4.7 Chair



ForwardedMessage.
eml.msg



**Attachment E
Draft Agenda and Minutes**

TC 4.7 Handbook Subcommittee
5:00-6:00 pm, Tuesday, January 27, 2015
Empire Ballroom (Lobby), Palmer House
Chicago, IL

**TC 4.7 Handbook Subcommittee
Agenda
Atlanta**

**Tuesday, June 30, 2015
5:00-6:00pm,
Room: Salon C, Atlanta Hilton**

- 1) Introductions and Agenda Review (5 minutes)
- 2) Schedule for 2017 Fundamentals Handbook Revision
 - a. June 2015, 50% draft (not there yet)
 - September 2015 (50%)
 - December 2015 (90%)
 - b. January 2016, 95% draft to TC for review
 - c. June 2016, TC approves revised chapter (final due June 21, 2016)
 - d. Early 2017, review galley prints
 - e. June 2017, publication
- 3) Reminder of target audience description
 - a. See doc link below
- 4) Reminder of editing process
 - a. 2013 Chapter 19 doc in Dropbox folder. See link below
 - b. Use track changes to add notes and edits. Otherwise changes will not make it into the 2017 version.
 - c. Files with tracked changes may be emailed to Erik Kolderup, erik@kolderupconsulting.com.
 - d. Source files and references may be uploaded to the Dropbox folder.
- 5) Review outline of proposed changes and discuss assignments for committee members.
 - a. See 2013 Outline link below for reference.
- 6) Assign action items

Resources:

- Word version of 2013 Chapter 19 for review and markup. In Dropbox folder: <https://www.dropbox.com/sh/9vnx7g99u6xvex2/Uv3Nv8LdeJ>
- Outline of Chapter 19 including proposed changes for 2017 with committee member work assignments. In Dropbox folder: <https://www.dropbox.com/sh/9vnx7g99u6xvex2/Uv3Nv8LdeJ>
- Description of target audience. Google Doc: https://docs.google.com/document/d/174pP_sNvLlSMAlaZTMTomWh9wiUibwTdl7i4EY7nBrE/edit?usp=sharing

**TC 4.7 Handbook Subcommittee
Meeting Minutes
Atlanta**

Tuesday, June 30, 2015

5:00-6:00pm,

Room: Salon C, Atlanta Hilton

Name	Email	Interest	Initials
Erik Kolderup, chair	erik@kolderupconsulting.com		X
Agami Reddy	redyta@asu.edu	Data driven modeling	
Alamelu Brooks	Alamelu.brooks@icfi.com	Validation, calibration	X
Andy Brophy	Abrophy89@gmail.com	Calibration, occ beh	
Anthony Fontanini	fontania@iastate.edu	DDM, sim components	
Artem Zkukov	Green.azkukov@gmail.com	MPC, param. studies	
Bass Abushakra	abushakr@msoe.edu	DDM	X
Charlie Curcija	dccurcija@lbl.gov	Calibration	
Cheng Xian Lin	lincx@fiu.edu	Data centers	
Chip Barnaby	chipbarnaby@gmail.com	Loads	
Chris Baker	chrisb@twgi.com		
Chris Balbach	cbalbach@psdconsulting.com		
Craig Wray	cpwray@lbl.gov		
Dan Fisher	dfisher@okstate.edu		
Dru Crawley	Dru.crawley@bentley.com		
Edmund Wong	Edmund.wong@arup.com	Calibration, DDM	
Hyojin Kim	kiml@cua.edu	DD, calibration, occ beh	
J. Patrick Carpenter	facperfeng@comcast.net		
Jeff Haberl	jhaberl@tamu.edu	DD, calibration	X
Joe Huang	yjhuang@whiteboxtechnologies.com		
Joel Neymark	neymarkj@msn.com	Validation	X
John Pruett	jap@zmm.com	Calibration	X
Juan-Carlos Baltazar	jcbaltazar@gmail.com	DDM/calibration	X
Kris Kinney	kinneyecg@gmail.com	DDM/calibration	X
Larry Degelman	ldegelman@suddenlink.net		
Liam Buckley	Liam.buckley@iesve.com	Nat vent/mixed mode	
Mahabir Bhandari	bhandarims@ornl.gov	Calibration	
Malcolm Cook	Malcolm.cook@lboro.ac.uk	Airflow modeling	
Mark Adams	adamsmb@ornl.gov		
Mark Seymour	Mark.Seymour@futurefacilities.com		
Michelle Sadegny	msadeghy@group14eng.com		
Mini Malhotra	malhotram@ornl.gov	DDM, calibration	

Mitch Paulus	mitchpaulus@tees.tamus.edu	Data driven modeling	X
Neal Krus	Neal.krus@bigladdersoftware.com	Ground heat transfer	X
Patrick Carpenter	facperfeng@comcast.net	DD	
Peter Armstrong	parmstr@mit.edu	MPC, CRFT, Perf maps	
Ralph Muehleisen	rmuehleisen@anl.gov	Uncert., occ behav, cal.	X
Ron Judkoff	Ron.judkoff@nrel.gov	Validation	X
Russell Taylor	tailored@utcc.utc.com	Calibration	
Sam Brunswick	sbrunswick@taylor-engineering.com	NV, mix mode, occ beh	
Samira Elkhmalchi	selkhamlchi@worldbank.org	DDM, occ behav	
San Hoon Lee	sanhlee@lbl.gov	Calibration, occ behav.	
Siddharth P	spremkumar@gilbertmech.com	HVAC sys design	
Taylor Roberts	troberts@group14eng.com	DDM	
Tianzhen Hong	thong@lbl.gov	Occupant behavior	X
Tim McDowell	mcdowell@tess-inc.com		X
Umberto Berardi	uberardi@wpi.edu	Calibration	
Vern Smith	Vernon.a.smith@gmail.com		

1. Reviewed the schedule for the 2017 Fundamentals Handbook Revision
 - a. June 2015, 50% draft (not there yet)
 - i. September 2015 (50%)
 - ii. December 2015 (90%)
 - b. January 2016, 95% draft to TC for review
 - c. June 2016, TC approves revised chapter (final due June 21, 2016)
 - d. Early 2017, review galley prints
 - e. June 2017, publication
2. Briefly discussed the target audience definition
 - a. The definition is in a Google doc: link below.
- 2) Reviewed the editing process
 - a. Get the 2013 chapter Word version from the Dropbox. Link below.
 - b. Add comments and/or use Track Changes for edits and save as a separate version.
 - c. New contributions and Online Handbook content (spreadsheets, color graphics, etc) may be provided as separate documents
 - d. Email your document(s) to Erik Kolderup, erik@kolderupconsulting.com.
- 3) Chapter outline review and roles for committee members.
 - a. Reviewed the outline of Chapter 19 including proposed changes for 2017: "HOF Chapter 19 Outline 2013+2017 Changes_06-25-2015.docx".
 - b. Names of committee members assigned to each section are listed in the outline.

- c. McDowell and Kruis to propose reorganizing and consolidating sections related to modeling approaches, characteristics of models, and modeling strategies.
- d. See also the document "HOF 2017 Chapter 19 Outline_Draft 07-01-2015.docx" for notes from the discussion of proposed changes and an updated draft outline.
- e. Kolderup will investigate using Basecamp to track comments on drafts.

4) Next steps

- a. Kolderup. Doodle poll to set web meetings. Proposed September, October, November, December meetings.
- b. Kruis and McDowell. Revised outline.

5) Adjourn 5:55 pm

Resources:

- Word version of 2013 Chapter 19 for review and markup. In Dropbox folder: <https://www.dropbox.com/sh/9vuz7g99u6xyev2/Uv3Nv8LdeJ>
- 2017 Chapter 19 Draft Outline. In Dropbox folder: <https://www.dropbox.com/sh/9vuz7g99u6xyev2/Uv3Nv8LdeJ>
- Description of target audience. Google Doc: https://docs.google.com/document/d/174pP_sNyLlSMAldZTMT0Mwh9wiUibwTdl7i4EY7nBrE/edit?usp=sharing



Agenda and Minutes not provided by SSPC 140 Chair

**SSPC 140 Meeting Summary –6/29/15 (submitted to TC4.7 6/30/15,
resubmitted with minor edits 1/8/16)**

Standard Method of Test for the Evaluation of Building Energy Analysis Computer Programs.

- This is the 25th anniversary of the Std 140 committee; PC founded in 1990.
- **Current IRS rules** (IRS notice 2008-40, published Apr 2008) relating to the deduction for energy efficient **commercial buildings** require software used for assessing tax credits be tested to Standard 140-2007. Currently **13 programs are qualified**; 8 programs qualified updated versions. (Last check 22Jun2015). **New submittals** ron.judkoff@nrel.gov
Qualified programs listed at <http://energy.gov/eere/buildings/qualified-software-calculating-commercial-building-tax-deductions>
- RESNET lists **8 (up from 6, last check 22Jun2015)** tools as either accredited for HERS ratings, tax credit compliance, IECC performance verification, or existing home tax credit compliance. Required tests include NREL's HERS BESTEST (included in Std 140-2011,-2014), along with equipment modeling and other modeling tests developed by RESNET. **New submittals to RESNET** (<http://www.resnet.us/professional/programs/software>).
- **ASHRAE 90.1 and 189.1 reference Standard 140**;
 - 90.1-2013, published Fall 2013 updated their reference to 140-2011.
- **2015 IECC cites 140-2011**; IGCC citation accords with IECC.

Standard 140-2014 Continuous Maintenance Revision Published:

- Adds ground-coupled slab analytical verification tests to 140-2011 tests.
- **SSPC 140 agreed on continuous maintenance proposal to submit to SSPC 90.1, to update their reference from "140-2011" to 140-2014".** Neymark to submit asap.

Proposed Addendum A to 140-2014. (ASHRAE RP-865 Airside-Mechanical Equipment tests adaptation):

- Test suite based on ASHRAE RP-865; first 140 suite based on ASHRAE research.
- Airside analysis of Fan Coil (FC), Single Zone (SZ), Constant Volume (CV), and Variable Air Volume (VAV) systems.
 - These are steady-state analytical verification tests.
 - Provides basis for future Volume 2 test suite with hourly varying weather, and other steps toward testing performance in more realistic (less idealized/in-depth-diagnostic) context.
- Robust participation: 7 simulation trial participants from 4 countries + Quasi-Analytical Solution by NREL.
- Planning for NREL final report during late2015/early2016.
- Standard 140 adaptation during 2016.

Building Thermal Fabric Tests Update (140, Section 5.2)

- **Address advances in modeling state of the art since 1995**
- Iterate on spec revisions and simulation trials, with draft NREL final report including updated spec and example results.
- **Consideration of revisions to existing test cases and inclusion of additional excursion (parametric sensitivity) test cases continues in collaboration with SSPC 140.** Test case revisions must be compatible with current parsimonious framework of the test cases.
- Consider including version of the spec in OpenStudio (gbXML compatible) format for automated input.

Test suite progress:

- First round simulation trial
 - Updated test spec distributed July 22, 2014.
 - Results received Sep – Nov, 2014; compile by NREL Jan 2015
 - **7 participants from 7 countries**
 - Good/constructive comments on spec.
- 2nd round simulation trial revisions
 - 17 topical revisions, to address comments from January
 - Some work remains.
 - Working Group (software developers) addressing first round results disagreements
 - Add extension cases as time allows; extension cases can be completed during additional rounds.
 - Window excursion cases for other glass types, and including window frames.
 - Weather driven infiltration cases – keep constant infiltration rate cases in base case to reduce noise.

Next steps:

- Continue topical revisions
 - Equivalent constant surface coefficients for programs that do not automatically calculate convective and/or radiative surface heat transfer.
 - A couple others remain.

Empirical Validation: SSPC 140 is interested in including empirical validation test suites IF they are worthy (high quality experimental data, with well vetted test specifications). On this topic we heard presentations from”

- R. Judkoff of NREL re forthcoming DOE sponsored data sets
- T. Hong on IEA BCS Annex 58
- J. New on ORNL.

References to Standard 140. Standard 140 is referenced by:

- IRS, Standard 90.1
- Standard 189 (High Performance Green Building Design) Appendix D
- IECC, IGCC
- The newly developing COMNet (BPI, Energy Foundation et al) User’s Manual.
- Implicitly referenced for ASHRAE Building Energy Quotient IF that is based on the COMNet User’s Manual;
- RESNET references Section 7 tests (adapted from HERS BESTEST 1995).
- Florida Building Commission
- Various international references.

Full SSPC 140 meeting notes are available from the Chair on request.

Listing of test suites either included in Std 140 or listed in Annex B23 (of Std 140) is included below. (Included per Jan 2010 request by TC 4.7 Chair; a more comprehensive listing requires a literature survey.)

Analytical Verification Tests and Comparative Tests already in Standard 140 (or with addenda in progress)

- NREL/IEA 12/21 "IEA BESTEST" (building thermal envelope fabric load tests)
- NREL/IEA 22 "HVAC BESTEST Volume 1" (analytical verification tests)
- NREL/IEA 22 "HVAC BESTEST Volume 2" (comparative tests)
- [NRCan](#)/IEA 22 "Furnace BESTEST" (analytical verification and comparative)
- NREL/HERS Council "HERS BESTEST" (comparative tests, simplified residential)
- NREL/IEA-34/43 "Ground-Coupled Slab-On-Grade In-Depth Tests" (analytical verification)
- NREL/IEA-34/43 "Multi-Zone Non-Airflow" (analytical verification and comparative)
- ASHRAE RP-865 "Air-Side Mechanical Equipment Analytical Verification Tests"

Other Analytical Verification and Comparative Tests

- NREL "BESTEST-EX" (comparative physics and calibration tests, existing homes)
- ASHRAE RP-1052 "Development of an Analytical Verification Test Suite for Whole Building Energy Simulation Programs – Building Thermal Fabric
- "RADTEST Radiant Heating and Cooling Test Cases"
- IEA-34/43 Airflow Tests by Japan (final report still in progress)

Empirical Validation Tests

- "ETNA BESTEST Empirical Validation Test Specification (NREL and [Electricite de France](#))
- IEA-34/43: "Empirical Validations of Shading/Daylighting/Load Interactions in Building Energy Simulation Tools (EMPA, Switzerland)
- IEA-34/43 "Chilled Water and Hot Water Mechanical Equipment and Control Comparative and Empirical [Validaiton](#) Tests (empirical and comparative, TUD, Germany)
- IEA-34/43 "Double-Skin Façade Empirical Validation Tests" (Aalborg U., Denmark).
- IEA 22 "Daylighting/HVAC Interaction Tests for the Empirical Validation of Building Energy Analysis Tools (Iowa ERS, US)
- IEA 22 Economizer Control Tests for the Empirical Validation of Building Energy Analysis Tools (Iowa ERS, US and Spain)
- IEA ECBCS Annex 42: Comparative Testing and Empirical Validation of Annex 42 Models for Residential Cogeneration Devices ([NRCan](#))
 - o http://cogen-sim.net/index.php?pg=&download=Annex_42_ST_B_Final_report_on_comparative_testing_and_empirical_validation.pdf
- New Research: There is a possibility of developing a test facility for empirical validation of software used to model retrofits of existing building (i.e., software that is currently the subject of the BESTEST-EX test suite). Such a test facility would be expensive relative to developing comparative and analytical verification tests, but such expense would be well justified if U.S. energy policy moves towards supporting energy efficiency retrofits of energy-inefficient houses that comprise a large portion of the current U.S. housing stock.